

ON THE  
PREVENTION OF TUBERCULOSIS.

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## P R E F A C E .

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The following paper upon the "Prevention of Tuberculosis" was published in Glasgow during the earlier part of the present year. The subject is so clearly expressed and so admirably treated that the State Board of Health, with the consent of the author, has decided to reprint the principal portion of the pamphlet for popular distribution, with the hope that the information therein imparted may aid still further in diminishing the destructiveness of consumption in Massachusetts. The omitted portions are mainly the appendices containing local matter, and the recently issued circulars of different municipal authorities.

The diagram on page 35 has been remodelled so as to include the statistics for consumption in Massachusetts. A table is added giving the figures of Massachusetts together with those of Glasgow. The circular of the Board on the same subject is also appended.

It is hoped that this paper will tend to quiet unnecessary alarm in relation to the real dangers from the infectious nature of consumption, since, while it shows very conclusively that the disease is infectious, it also shows that, with proper precaution, there is practically no danger from association, even quite intimately, with consumptives.



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# ON THE PREVENTION OF TUBERCULOSIS.

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## INTRODUCTORY.

IN December, 1891, the Medico-Chirurgical Society of Glasgow, after a discussion, came to the following resolution:—“That a Memorial be presented to the Town Council of Glasgow calling their attention to the fact that tuberculosis is now fully recognized as an infectious disease, and asking them to take the matter into their serious consideration, with a view to the protection of the community from the infection.” A Memorial was accordingly drawn up and submitted to the Committee on Health in January, 1892. It was remitted to me for consideration and report.

The signatures appended to this Memorial are sufficient to secure for it respectful consideration. They guarantee that whatever it contains of positive statement as to the nature of tuberculosis is accurate, and that whatever of suggestion it makes as to practical measures is judicious. Still, the attitude of the administrative mind towards the contributions of science to the stock of knowledge and towards their executive application and effect is different. We receive implicitly and with gratitude the results of the laboratory and the study; we apply our own judgment to executive proposals. We are bound to consider their bearing on general policy, and to determine their expediency from a forecast of the advantages and disadvantages likely to follow their adoption. This distinction was clearly present to the minds of the Memorialists. No representation relative to

the duties of the Local Authority could have been made with greater tact and discretion. It is a distinction which is very well illustrated in the history of the subject of the Memorial. Koch's paper on "The Etiology of Tuberculosis," published in 1884, contains practically all the scientific facts necessary for the guidance of preventive administration. No essential statement made by Koch has been impugned, and nothing of importance has been added.\* It is otherwise with the detailed application of his facts. This has been gradually developed by remarkable investigations specially directed to that end; by the discussions of such bodies as the Congress on Tuberculosis, held in Paris in 1888, 1891, and 1893, the French Academy of Medicine in 1889-90; by successive International Hygienic and Medical Congresses, etc.; by specialists engaged in administration, such as the German Public Health Association in 1889, and the Incorporated Society of Medical Officers of Health of England in 1893; by reports on special references made by these bodies to experts; and by numerous State and Municipal Authorities in various parts of the world, who have from time to time actually taken administrative action. There has, therefore, been an obvious advantage in delay. In the enthusiasm naturally inspired by a new discovery, there is always an element of danger. When the issues concern interference with human conduct, and involve the personal liberty of a considerable section of the community, even on the plea of the safety of the remainder, we are bound to ask if the game is worth the candle. The first disciples of a new doctrine must be enthusiasts. The regimen dictated from the laboratory is gradually moderated by the expediency of the administrative bureau. The practical methods of dealing with the infection are now better understood, and

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\* It is not meant that everything relative to the infectivity of tuberculosis in Koch's "Etiology" is new. Cohnheim, in his pamphlet, "Tuberculosis as an Infectious Disease" (1880), reasons out with as much clearness as was possible before the actual discovery of the infecting bacillus (Koch, 1882) many facts as to infection and its methods, especially inside the body. He first popularized the idea of infection as regards tuberculosis.

have, in consequence, been greatly simplified. Their importance in relation to general hygiene is now seen in more just proportion. I have, in the interval since this Memorial was remitted to me, followed closely all these discussions and investigations, and have collected everything in the shape of reports and documents which serves to show what is the general attitude of the administrative mind to this important subject, more especially in the country to which we owe the knowledge of the facts which we are told call for administrative action.

### TUBERCULOSIS IN GENERAL.

#### *What is Tuberculosis?*

The word tuberculosis, or tuberculous disease, is associated in the popular mind almost exclusively with phthisis or consumption of the lungs. This is by far the most frequent and most deadly form of tuberculosis; but every organ and every tissue of the body may be the seat of tuberculous disease. Hydrocephalus is tubercle in the membranes of the brain; tabes mesenterica is tubercle in the lymphatic glands of the abdomen; scrofula, in the popular sense, is tubercle in the superficial lymphatic glands, most familiar in the neck; lupus is tubercle in the skin; there is tubercle of the joints and of the bones, giving rise to suppurations in all sorts of places, and occasioning surgical operations almost as various in their nature as in their locality.

Tuberculosis is a disease, not only of man, but of the lower animals. No warm-blooded animal is insusceptible when artificially tested, but it occurs naturally with great frequency in those which are domesticated or confined, as the cow, the pig, the rabbit, in fowls, in monkeys, etc.

The only cause of tuberculosis is the tubercle-bacillus. Without the bacillus there can be no tuberculous disease. Therefore, to prevent tuberculosis, we must get rid of the bacillus. From our point of view, tuberculosis is a disease. From the point

of view of the bacillus, it is a natural life-process. The bacillus has a plan of life laid down for it, providing, as usual, for the maintenance of the individual and the propagation of its kind. Clearly, it is necessary that we should understand this plan before we can hope to disconcert it. The prevention of tuberculosis rests upon the biology of the bacillus.

### *The Biology of the Bacillus.*

The bacillus is not inherited. As regards pulmonary consumption, this statement may be taken as absolutely true. The bacillus *may* pass from a tuberculous parent into the body of the foetus, and be born with it; and thus the offspring may carry into independent life a tuberculous process, but this fact has merely an academic interest. Tuberculosis has been actually seen in the foetus with just sufficient frequency and certainty to prove that the inheritance of the bacillus is not impossible. For all practical purposes, the hygienic administrator is bound to regard *every* case of tuberculosis as caused by infection which has taken place so to speak in the open—within the sphere of his control.

The tubercle-bacillus not being inherited, but passing into the body from the outside, how does it get there? Under what conditions does it exist there? Under what conditions does it pass from the outside to the inside of the body? Under what conditions does it live and propagate there? It is impossible to demarcate the answers to these questions as clearly as the questions themselves. In nature the facts are interlaced, but, at any rate, the questions so stated will promote clear thinking.

The bacillus multiplies by subdivision and by the production of spores. As compared with other disease-producing organisms, it grows very slowly even under the most favorable circumstances. To be effective, therefore, these circumstances must be maintained for weeks continuously. At a temperature of 86° F. growth is much enfeebled, and it entirely ceases below 82.4° F. It cannot grow at a temperature above 107.6° F. It flourishes

at the natural deep temperature of the human body, viz., 99° to 100° F.\* Moisture is absolutely essential to growth, with a limited supply of air and an absence of light. Obviously, we have here an aggregate of conditions which, in this country at any rate, can only be found in nature *inside the animal body*. The tubercle-bacillus cannot multiply outside the animal body; it can merely live, and live only under certain conditions, and under any conditions only for a limited time.†

When the bacillus obtains access to the body of a warm-blooded animal, which it almost solely does by the great main entrance, the mouth, passing thence into one or other of the diverging channels, the windpipe and the gullet, it is not yet in a physiological sense inside the body. It must break through the mucous surface of these passages. This is a most important stage in the career of the bacillus from a preventive aspect, which must be dealt with at large further on. Meanwhile, let us assume that the bacillus has broken through, still it has enemies in the tissues and fluids of the body. These also have a supreme interest for us, but these also we shall meanwhile pass by. If every circumstance has proved favorable, the bacillus proceeds *slowly* to multiply, and in doing so to invade and break down the natural tissue around. It may be borne along the stream of lymph or blood, or be carried by wandering cells to other parts of the body. However it may be effected, in all movement the bacillus is passive. Wherever it establishes tuberculosis, the process has products—irritated and disorganized tissue, pus, etc. These products have the relation of foreign bodies to the healthy tissues, and have therefore an eccentric or centrifugal bias. They may, however, be imprisoned and retained, sometimes changed in nature. If the process lies on the line of the great channels by which the bacillus gained entrance, then it has an equally patent exit—in consumption, by the expec-

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\* The tubercle-bacillus of fowls has a somewhat wider range of temperature.

† The bacteriologist produces those conditions artificially, and finds it a very difficult task.

toration, or by the faeces, if the expectoration is swallowed. If the process is in the bowel or the kidney, or any organ having a natural exit for its products, then the morbid matter passes out thus. If the process is in bone or in lymphatic glands, or in any locality from which the nearest way outwards is through the skin, then we may have abscesses and a discharge of matter therefrom. To us this is a feature of disease. To the bacillus it is a phase in the cycle of its life. These discharges carry out bacilli and their spores; and these bacilli and their spores maintain the stock of infecting material outside the animal body upon which the continuance of the tubercle-bacillus as an individual and of tuberculosis as a disease depends.

What are the conditions which favor the continued vitality of the bacillus, and preserve the potential activity of its spores outside the animal body?\*. Although the bacillus will not grow, excepting under the conditions of heat and moisture described, it is not killed either by natural cold or heat, or by drying. It is, indeed, one of the hardiest of all disease-producing germs. Freezing has no effect. It resists putrefaction for weeks, and endures in the dry state for months. The greater stability in resisting natural agents and conditions to which other germs speedily succumb is, no doubt, compensatory for the characteristics of parasitism and slow growth. If the bacillus, being unable to grow anywhere but inside a warm-blooded animal, were also unable to survive outside, it would be exterminated. On the other hand, from the animal's point of view, the extremely sluggish growth of the bacillus, and its inability to grow outside, in a measure countervails its tenacity of life, otherwise the animal would be exterminated. Still, in spite of this tenacity of life, the combination of hostile conditions outside the animal body ultimately proves fatal to the bacillus. Direct sunlight will kill the bacillus in a few minutes, and ordinary daylight in a few days, whether it be exposed naked in cultures, or in sputum or .

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\* It is impossible to speak separately of the bacilli and their spores. Observations and experiments really refer to the loss or the retention of the property of infectivity.

in dust, and in each case free flowing air makes the light more active. The converse of these conditions — darkness and stagnant air — favor the bacillus.

#### TUBERCULOSIS IN MAN.

Hitherto we have dealt with tuberculosis in its general sense, without reference to the species of the animal in which it is found, or the locality of the body where it is seated. In harmony with the general law of life, the bacillus is varied by the soil in which it grows, and the disease to which it gives rise derives characteristics both as to locality and nature from the physiological idiosyncrasies of the species. For these reasons, and since it is in man that we are *directly* interested, we shall now consider specially *tuberculosis in man*.

Putting aside, as of no practical importance, the very rare case of inheritance of the bacillus, man, like other animals, suffers from tuberculosis only when he receives the bacillus from without. Putting also aside, as of no great practical importance from a sanitary aspect, cases which arise from direct inoculation by wounds or through scratches and other ruptures of the integrity of the skin, it may be said that the bacillus always enters by the mouth, that it is either inhaled or swallowed, that it is conveyed either in the air or the food, that it enters either by the lungs or the alimentary canal, or stops short in the structures in and adjacent to the mouth.

Every bacillus and spore thus inhaled or swallowed must have been produced in an animal, not merely derived from or descended from a bacillus or spore produced in an animal, but must itself have passed out from a diseased animal or been included in the flesh derived from a diseased animal.

Tuberculosis in man is therefore caused by infection either (1) through the excretions or discharges from infected animals, including man himself, or (2) the milk of infected animals, including his own species, or (3) the flesh of infected animals.

*Infection by Sputum and other Discharges.*

There is a remarkable consensus of opinion that persons suffering from phthisis or consumption of the lungs are the largest contributors to the stock of what is very aptly called the "floating infection" which exists in the environs of men. Physicians, bacteriologists and pathologists, each reasoning on the line of the facts best known to them, concentrate upon this opinion. The hygienist sees no reason to dispute it. Nearly three-fourths of the deaths ascribed to tuberculosis are caused by consumption.\* Though the bacillus may reach the lungs by other paths than by the air, still the infection which establishes tuberculosis in the lungs and air passages is generally air-borne. Phthisis is the most frequent cause of phthisis. It is a sufficient cause. Phthisical persons are to be found in every place and in every condition and position in which healthy persons are to be found. Everywhere, therefore, tubercle-bacilli may be distributed. For this reason, while all that has been said as to the discharge of bacilli in tuberculosis generally is correct, phthisis has been regarded by all authorities who have taken special steps for the prevention of tuberculosis as either pre-eminently or alone among all its forms demanding precautionary measures. It is necessary, therefore, to enquire exactly how the bacillus is discharged and distributed from a case of phthisis; in what sense phthisis is and in what sense it is not infectious. For a knowledge of the latter is of as much importance as of the former. If we understand how phthisis becomes dangerous, we shall also understand the nature of the risks arising from tuberculosis generally.

The tubercle-bacillus is not "ubiquitous." It haunts the vicinity of the consumptive. It is not in the expired air. It is not in the cutaneous exhalations. It abounds in the sputum. It abounds in the dust of the apartment. It is a well-known physical law that fluid or moist surfaces will not part with solid

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\* In Glasgow, 1890-94, exactly 73 per cent.

particles by evaporation or to a current of air. Hence the absence of bacilli in the expired air, and hence they are likewise imprisoned in the sputum. Even particles of sputum sprayed into the air by the violence of coughing, being gross, subside at once, and could only infect if coughed into the face of some one, and mixed with the actually in-going air. In order to be air-borne, the sputum must be dried and broken up into dust. If discharged into a handkerchief, it speedily dries, especially if it is put into the pocket or beneath the pillow. In the last stages of consumption the patient becomes weak, the sputum is expelled imperfectly, pillows, sheets, handkerchiefs are soiled. If a male, the beard or moustache is smeared. Even in the hands of the cleanly, without special precautions, such circumstances all tend to the production around the patient of a halo of infected dust maintained by every process of bedmaking, or of cleaning which includes the pernicious process happily described as "dusting." In the hands of the careless and the dirty, the infectivity is, of course, greatly aggravated. It attains its maximum of intensity where the filthy habit of spitting on the floor prevails, especially if the floor is carpeted.

The remedy is simply to spit into a spittoon containing a little water; and when a handkerchief must be used, to see that it never dries. Immerse it in water, and ultimately boil it. <sup>A</sup>Better still, use a piece of cloth or paper, and burn it at once. Cornet found that where the spittoon was used, and cleanly habits prevailed, there were no bacilli in the dust; where handkerchiefs were used, even though there was no spitting on the floor, there the dust was infective.

This is the golden rule in dealing not only with sputum but with *all* forms of tuberculous discharge, with the *fæces* when they are infected, the pus from tuberculous sores and abscesses, etc. *Keep them moist.* Especially do not allow any soiled linen or dressings to lie about and dry. Make it impossible for the discharges to pass into the condition of dust.

It is not merely the dried substance of the discharge which

determines the bulk of the danger. All dust must be regarded as suspicious in the neighborhood of consumptives. If there is any infection at all about, it is there. The ordinary constituents of dust—the fibres of linen and cotton, the shreds of wool—all act as rafts on which the infective germs are borne about, and with which they rise when disturbed.

The infected dust in apartments occupied or frequented without precautions by consumptives will subside indiscriminately upon any exposed surface, and may thus ultimately be swallowed, *e. g.*, upon plates, cups, glasses, basins, etc., viands of all kinds and fluids, such as milk or water. The latter are the most dangerous. They present more or less moist surfaces. No dust which falls on them can be blown away again, nor can they be cleaned.

The first person to suffer from carelessness with reference to sputum is the patient. He breathes an infected atmosphere, and in the struggle which is going on between his tissues and the bacillus, the latter is constantly reinforced, fresh territory is invaded, and the chance of recovery is destroyed. Auto-infection is one of the unavoidable risks of phthisis. The chances of this occurring ought not to be knowingly increased. The use or misuse of handkerchiefs, and swallowing the sputum, are both likely occasions. These facts bring the precautions necessary in the public interest within the scope of the duties of the private physician in the treatment of a case of phthisis.

#### *Infection by Milk and Flesh.*

The other sources from which man may derive the infecting bacillus are the milk and the flesh of diseased animals. That infection through the stomach is possible, we know from the observed effect upon consumptives of swallowing their sputum, and from experiments with animals. The process of cooking tends to diminish the risk; but in the case of milk, there is no such safeguard interposed, owing to the habit of the country to consume it raw. The primary seat of tuberculosis in children

is so frequently in the bowels and their related glands, and milk forms so large and essential an element in the food of children, that we cannot avoid the conclusion that it is to them a frequent source of infection. There is ample room for public interference to prevent the spread of tuberculosis by meat and milk, but, above all, by milk.

*The Conditions which Control Infection.*

Although without the bacillus there can be no tuberculosis, we cannot call it the sole cause of the infection in the individual case. The theory of infection has a profound influence upon the practical aspects of prevention. So long as we believe that infection is guided from person to person by supernatural agency, without regard to physical laws, we can do nothing. When we advance to the conception that the infecting element is material, and subject to physical laws, we have taken a great stride towards precision, both in preventing and curing the disease. As we ascertain that the element is solid, then that it is organic, we become more precise, until with the knowledge that infection passes with the body of a microbe, a minute living being, we are ushered into the study of those complicated conditions which surround the maintenance and development of life.

We have already learned something of the restrictions imposed upon the tubercle-bacillus by some of those conditions. It can grow only within warm-blooded animals. It retains *vitality* with considerable tenacity outside the body, especially when dried, but sunlight, free air, and other natural agents, which first kill and then disintegrate, wage steady war against it. In the long run, therefore, only a fraction of the total quantity of infecting material survives until it has the opportunity to infect.

When at last the bacillus reaches its natural habitat, disease is not necessarily caused thereby. In other words, but a small proportion of all who are exposed to infection, who actually inhale or swallow the bacillus, are infected. Every breath we inhale is loaded with particles of all kinds, organic and inorganic,

dead or possessing the potency of life. A large proportion of this microscopic dust is caught in the nasal passages in the case of nose-breathers. Tubercle-bacilli have been found in the discharge from the noses of the attendants in wards occupied by consumptives. The moist lining of the air-passages catches the dust which passes the nose. The breath we exhale is optically pure. There are arrangements for expelling such particles — for scavenging the air-passages. If there were not, our wind-pipes would get choked as surely as unswept chimneys. What may be called local health is more important as a protection from the tubercle-bacillus than any other of the species of disease-germs, especially the integrity and vigor of the organs by which it enters the body. The bacillus is slow to develop, therefore there is a longer interval for its expulsion; but any catarrh, however local, anything which interposes a mechanical obstruction, or weakens the expelling power, or hampers the movements of the lungs, or provides crevices as resting-places, interferes with the expulsion of the bacillus, as of every other sort of foreign matter. In like manner, any impairment of the functions or integrity of the stomach or bowels favors infection; but inasmuch as the business of the stomach is to resolve and break up, and its acid juice is inimical, while in the bowels there are swarms of competing microbes, and the struggle for life is keen, the bacillus is more likely to perish in these regions. Still, anything of the nature of indigestion or local irritation may give the microbe a chance.

These are all obstacles to entrance within the substance of the tissues, for, as has already been said, the tubercle-bacillus is no more inside the body after it has passed the portal of the mouth than when it is floating in the dust of the air or in the milk of a tuberculous cow. It is nearer, but *there has been no infection*. When it has effected a lodgment in the tissues, the production of disease depends upon the defeat of the antagonistic forces which surround it. These amount to nothing more than constitutional vigor — tissue-health. A condition of perfect health

is one of insusceptibility. In this condition the juices of the tissues are poisonous to microbic life, and their cells active agents of destruction. Depression of vital resistance by disease, debauchery, fatigue, want, even by mental causes, induces susceptibility. Susceptibility may be constitutional, and may be so great and so marked as to amount to a predisposition. This it is which passes by inheritance, and, until the discovery of the bacillus, was regarded as hereditary tuberculosis. It is not the disease which is inherited. It is the pre-disposition — the feeble constitution, the low vitality, the *tout ensemble* of conditions, some of which are recondite and imperfectly understood, some obvious and capable of specification and comprehension. The outcome is a soil so congenial as to accept a delicate infection, from which the majority of mankind emerges absolutely scatheless; a soil which sustains and propagates the bacillus so vigorously that to popular observation the disease seems to be inherited. In such a person a blow or a sprain, a cold or sore throat, determines the local incidence. Nothing shows the reality of the antagonistic forces with which healthy animal tissues are endowed more strikingly than the numerous recoveries which take place, especially from pulmonary infection. In such cases there has been some temporary local susceptibility; but the vital forces have rallied, have invested the detachments of invaders, have cut off their convoys and scouts, and ultimately starved them out. The fact is undoubted. There is nothing in the world to accomplish this result but the native forces of the tissues. The phrase sounds rather mystical and metaphorical; but the forces are real, and may very confidently be trusted as most important allies in any general campaign against tuberculosis.

In such a contest as that which we have depicted, and alike in both stages, the number of bacilli engaged must obviously have an important relation to the result. It is impossible to express oneself without appealing to the analogies of warfare. In the stage of endeavor to obtain a footing, numbers must tell

as effectively as in storming a breach; in the stage of maintaining a footing, as effectively as in the resistance of a garrison or the progress of an invasion. This introduces the all-important preventive doctrine of dilution. Infection is fifty times more likely to occur if there are fifty bacilli in each breath of air or pint of milk than if there is but one. Apart, therefore, altogether from the wholesomeness of ventilation and the vital energy imparted thereby, the merely mechanical effect of diluting or reducing the concentration of infective germs in air has an important protective and preventive power.

#### WHAT OUGHT THE LOCAL AUTHORITY TO DO?

##### *Is Tuberculosis an Infectious Disease?*

Now that we have come to the practical issue of this inquiry, it is well at once to raise the question—Is tuberculosis an “infectious disease?” The answer is—Yes and No. It must be apparent from what precedes that, while in the *academic* sense tuberculosis is infectious, in the popular sense it is not. Even in the language of the schools, where words are weighed and meanings are qualified to a nicety, hydrocephalus, although it is tuberculous, cannot in any sense be said to be infectious; neither can many forms of tuberculosis of glands, bones and joints. Until a discharge is established, they cannot be infectious. Indeed, it is doubtful if even those cases of miliary tuberculosis of the lungs which have ended in recovery ever were infectious, and it is certain that no case of phthisis is infectious until the expectoration becomes specific. Tuberculosis, therefore, even in an academic sense, is a disease which, though in all cases caused by infection, is not in all cases infectious. There is no other infectious disease of which this can be said. The fact that it is not infectious in the popular sense is of much more importance for our present purpose. The popular idea of an infectious disease is one from which there is no safety save in keeping away from it. Proclaim a disease to be “infectious,” and the people will pay no attention to qualifications. It is very natural

— don't go near the person, and the conditions of safety need give no trouble! Education makes no difference. The fear of infection is indiscriminating even to absurdity. Enteric fever scarlet fever, whooping-cough, small-pox, all entail the same social ostracism.

There is a substantial excuse for the popular notion of an infectious disease in the fact that the law does not discriminate between one infectious disease and another. The words have a technical meaning, and every disease in the category is within the scope of every provision of the law applicable to infectious disease—compulsory isolation of the living and of the dead, compulsory disinfection, penalties for the use of public vehicles, for appearance in public places, whether streets or buildings, etc., etc. It may be said that the application of these laws is left to the discretion of authorities, which is true; but one has only to study the opinions advanced by some medical officers of health to be convinced that, before placing tuberculosis officially among "infectious diseases," it is necessary to understand quite definitely what is to follow. There is not a single power of interference with the liberty of persons suffering from small-pox, the application of which to consumptives has not been advocated. Indeed, one cannot avoid contrasting the studied caution and expressed solicitude to protect the consumptive from prejudice, which characterizes the application by the original German investigators of their discoveries to prevention, with the rash utterances of many of those who seek to interpret those discoveries elsewhere. Koch himself showed the example in the closing words of his famous treatise, "It seems to me the time has now come to adopt prophylactic measures against tuberculosis. But, owing to the wide distribution of the disease all steps taken against it have to deal with social relations, and it must therefore be carefully considered in what way, and how far, we may proceed without neutralizing, by unavoidable disturbances and other disadvantages, the benefit obtained."

Push aside the proposal to extend such demands to everything

that can be designated "tuberculosis" as condemned in the utterance. Consider them as applied to consumption alone. Recall all the representatives of that pale multitude one has known who bore the burden of their infirmity for years, few or many, who did good work in the world, earned honest wages, supported themselves, supported others; all those one has heard of who lived more in the world's eye, who have instructed or entertained mankind, consumptives who have enriched our bookshelves, given us paintings for our walls, and satisfied our ears with music; all the phthisical patients to whom Sir Andrew Clark preached from his favorite text—" *Labor vitæ vita est* — Work is the life of life," with himself as the example, born of parents who both died of phthisis, and sent to Madeira at twenty-one to die.\* They all suffer from an "infectious disease." They are all to be notified by the first physician who sees them. Each is to be "furnished with a card bearing the date of notification," which they are "required to produce on application for disinfectants, etc.," and which medical men, wherever they may have to consult a doctor, are to ask for, so that they may not cause unnecessary expense by being reported again, for economy must not be lost sight of.† The announcement of the sad diagnosis is to be signalized and proclaimed to the world by a domestic ceremony of purification, conducted by the high priests of the sanitary department, to wipe out all the infection which has followed the unfortunate's pestiferous steps while the taint was yet unrecognized. To put an end to this he must "be thenceforward confined to certain parts of the house," in which the ceremony of purification is to be carried out every two months. They are now known to all men as "consumptive people," and are in future to live up to a code. They must abjure pocket-handkerchiefs; when "attending a workshop, assembly, or church," they must "spit into a

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\* "The Treatment of Fibroid Lung Disease;" a Clinical Lecture. — *Lancet*, 6th January, 1894.

† Dr. Niven "On the Prevention of Phthisis." — *Lancet*, 10th August, 1895.

hand-glass spittoon," which "may be conveniently attached to the person;" their "eating utensils . . . should be kept separate from all eating utensils of other persons;" their "clothing must be washed separately;" their "bowel discharges should be disinfected."\* Even this is a compromise to which the sanitary puritan reconciles himself by the prospect of an ideal such as this: "In the wake of compulsory notification would follow a number of regulations all aiming at stamping out phthisis [surely a misprint for phthisics]. These subsequent regulations fall easily into three classes: (1) Prevention of patients with actual phthisis, or, indeed, with strong hereditary predisposition, from marrying. (2) Prohibition of patients with actual phthisis from frequenting churches, theatres, railway carriages, tram-cars, or any public places. (3) Disinfection of sputa, habitations, and all things coming in contact with phthisical patients. Isolation of the consumptive."†

Let us rapidly run over the various administrative procedures usually applied to infectious diseases, and consider them as applicable to tuberculosis.

### *Compulsory Notification?*

Although this has been frequently recommended in expert reports, and was voted by the Parisian Congress in 1888, and again in 1893, as necessary in reference to tuberculosis in general, the fact is chiefly noteworthy as a warning of the direction in which science, without practical discrimination, is moving. This would cover an enlarged cervical gland, a lupus, a white-swelling, a hydrocephalus, a "cold abscess," every form of local tubercle, as well as a case of phthisis. The question has in reality, as a rule, resolved itself into a discussion of the propriety of requiring the notification of consumption. Suffice it to

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\* Memorandum of the N. W. Branch of the Society of Medical Officers of Health as to the prevention of phthisis or consumption; also Dr. Niven's Manchester leaflet.

† "The Necessity for placing Tubercular Phthisis under Control."—Article by Arnold Chaplin, M.B., in the *Medical Magazine*, Vol. I., p. 1022. Exactly the same regimen is strenuously advocated in an article in the *Forum* for February, 1894.

say, that I am not aware of any country or place where this has yet been done. I am not aware of any resolution in favor of compulsory notification having been passed by any body of medical practitioners. On the contrary, the subject has been discussed by the French Academy of Medicine, the College of Physicians of Philadelphia, and the Medical Society of Oldham, with an adverse result. Even the Incorporated Society of Medical Officers of Health of England, when asked to resolve that "tuberculosis should be made a notifiable disease, notifiable under the same acts and under similar conditions to such disease as scarlet fever," passed instead a resolution to the effect that they, "while accepting the view that phthisis is an infective disease, in the prevention of which active hygienic measures should be taken, think it premature to recommend the compulsory notification of a *chronic disease like phthisis*" At the same time a rider was added encouraging voluntary notification and disinfection.\*

#### *Isolation?*

Here again it may be mentioned the extremists have proposed that sanitary authorities should provide hospital accommodation for tuberculosis, but practically the question is one of providing for consumption. We must carefully distinguish between the humanitarian and the sanitarian aspect of this question. The conditions which determine infection from phthisis are, as we have seen, very narrow. With proper precautions, they are obviated merely by sleeping alone. In small-pox and in typhus they are so wide as to include almost every case; in scarlet fever they are sufficiently wide to make removal to hospital advisable in three-fourths of the cases; and in enteric fever in about the same proportion. From the present point of view, the essentially dangerous case of phthisis is the one which is in the last stage, confined to the house or bedridden. When a person in this condition cannot have a bed alone, especially if young children must share it, when the material accessories of

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\* *Public Health*, September, 1893.

the special precautions necessary are wanting, when the conditions are hygienically bad, then removal would, from a preventive aspect, be useful. But this is a task different from any hitherto undertaken by local authorities, and one not to be lightly assumed—to provide, not a hospital for curative purposes, but a shelter for incurables, a “Friedensheim,” or “home of peace,” a place in which to die without endangering the living. Consumption hospitals, in the ordinary sense, are not open to such cases. I confess to considerable sympathy with the opinion of Dr. Squire,\* referring to this limited class of cases—“A sanitary district should provide a home for its own advanced consumptives, where the sufferers should be received, without thereby incurring the brand of pauperism; these invalids would thus be prevented from being unwilling dangers to others.” At all events, any provision which exists for the treatment of consumption ought to be patronized by the authorities. These doctrines give them a special interest in consumptives.

### *Disinfection?*

We already, when asked by medical practitioners, wash and disinfect after fatal cases of phthisis, but we seldom are asked.

The circumstances which require precautions in carrying out the washings of consumptives or other persons having tuberculous discharges are restricted very much in comparison with the ordinary infectious diseases. Indeed, we must avoid creating the impression that the bedding and clothing are necessarily infected. It is not so. They seldom are infected. It is the helplessness or carelessness of the patient which leads to infection of his garments, etc. Here again the advanced case, the fatal case, is the dangerous one; so that it would be well that washing and disinfection should, *always after death*, be undertaken by the authorities. If people possess the means of washing properly the clothing of the healthy members of their household, they can also wash the ordinary linen of a consumptive. I see

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\* “The Hygienic Prevention of Consumption,” 1893, p. 141.

no reason for interference even in the use of a common washing-house. If, however, people have not the requisite accommodation and appliances, if they are untidy and cannot be trusted to carry out any process of washing at all, then it might be carried out by the authorities, each case being considered in view of the circumstances. Whatever danger there is in any case emerges not from mere neighborhood or to mere touching of articles, or from the act of washing, but from the disturbance of dust when they are dry. The moment they are wet the risk is gone.

### *Popular Instruction?*

In Glasgow, for the last twenty years, the local authority has caused a paper, couched in simple language, entitled "Hints about the Prevention of Scarlet Fever," to be left at every house in which a case is known to exist. While it would be well to take similar means for the instruction of the people regarding tuberculosis, the dissemination of the knowledge of the facts we have been considering through the mass of the public must depend chiefly upon the medical profession. No doubt, every case of consumption will be made the occasion of some detailed instructions as to the nature of the risks entailed upon the family, and the method of obviating them. But there is room and use for popular instructions applicable to the special risks of consumption and of strumous sores. These might be supplied to public dispensaries, and given there to the appropriate patients; and, no doubt, many practitioners would welcome such papers for the more speedy and certain information of private patients. What ought to be in such pamphlets? We certainly do not wish any exposition of the whole etiology of tuberculosis. We do not wish to call names, and to run the risk of false impressions therefrom. We would meet the occasion of a case of consumption or a case of open tuberculous sores, and state as plainly as might be under what conditions the patients may live in the family, and follow the ordinary intercourses of life, with-

out causing risk to anybody. We would preach the gospel of cleanliness, fresh air, and sunshine, from a new text.

I have already remarked upon the tendency of the disciples of Koch, Cornet, and Heller, especially in this country, to out-Herod Herod in the application of their doctrines. One naturally looks to Cornet himself and to the city where he resides, where, in fact, the bacillus was discovered, and whence nearly all we know of it has been announced to the world, for guidance as to what it is expedient to teach the people as to consumption, and what it is necessary to require of consumptives by way of precaution for the safety of others. Here are (1) a leaflet which Cornet is in the habit of giving to his patients; and (2) a leaflet issued by the municipal authorities of Berlin:—

#### I. — CORNET.

##### *“Protection from Consumption.\*”*

“The most destructive disease of the human race is consumption (tuberculosis). It carries off a seventh of the population. In Germany alone there die yearly of consumption well nigh one hundred and fifty thousand people.

“It has now been discovered that this disease is caused by the inhalation of a germ, a so-called bacillus. It is infectious, that is, it can be given by any person to another. But neither the breath nor the perspiration of the patient is at all dangerous, as used to be supposed. Infection generally takes place through the spit, and, according to the latest inquiries, especially when the spit is discharged by the consumptive upon the floor or in a handkerchief, where it dries and becomes dust, and some of the swarm of germs contained therein are inhaled by healthy people.

“Many other diseases, such as diphtheria, pneumonia, and various forms of catarrh, may be communicated in a similar way.

“Consumptives endanger not only those about them, but themselves, through the drying of their spit, because they again inhale the discharged and dried bacilli, and thus infect hitherto sound parts of their lungs.

“Such infection may be avoided if consumptives, and, indeed, all who have a chronic cough with expectoration, keep this expectoration always moist; if they give up spitting on the floor or into

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\* “Ueber Tuberculose,” etc., etc., von Dr. Georg Cornet, Leipzig, 1890, p. 145.

a handkerchief, and always use a spittoon which is emptied down the water-closet.

“Spittoons must be placed wherever it appears necessary, in every inclosed space frequented by men. They ought not to be filled with sand or sawdust, but either left entirely empty or supplied with a very little water. They ought to be at hand in sufficient numbers in every apartment of houses, in workshops and factories, in counting-houses, schools, offices, public places, in corridors and on stairs, so as to give every one a convenient opportunity of observing these injunctions.

“In this way healthy people who have to remain within the same room as consumptives will be almost entirely protected from infection.

“Posters ought to be put up in factories, workplaces, etc., forbidding most strictly spitting upon the floor or into a handkerchief.

“On the street, where spitting can scarcely be prevented, certain other circumstances diminish the risk of infection.

“Let every man, even though suffering from an ordinary cough, discharge his spit, not on the ground, nor in a pocket-handkerchief, but always in a spittoon.

“Milk ought, as far as possible, to be used only after boiling, especially by children, invalids, and convalescents.

“By the strict observance of these injunctions, consumptives are made almost harmless to those about them; and all the more that the bacilli can live outside the body only for about six months, it may be hoped that, if these rules are followed out by the sick, consumption in general will diminish.”

## II. — BERLIN.

### “*Measures against the Spread of Consumption.*”

“Pulmonary and laryngeal consumption (tuberculosis) is communicated to the healthy by means of the tubercle-bacilli contained in the expectoration of the sick, when the spit dries, becomes dust, and is thus inhaled. The discharges from the bowels of such persons may in like manner act injuriously.

“*If those matters are rendered harmless, the spread of consumption is prevented;* the healthy are protected from the sick.

“In order to prevent drying and the production of dust, the consumptive, indeed *every* person who has a cough (people with a cough are often not aware that they are actually coughing up tubercle-bacilli), ought to spit in vessels containing a little water (spittoons of earthenware or glass). No person ought ever to spit upon the floor or into a pocket-handkerchief. For the reception of sputum, spittoons should be placed in the dwellings of all who are ill with a cough, and, indeed, in all houses, on the stair land-

ings, but especially in such buildings and rooms as are used by the public (hotels, restaurants, places of amusement, meeting places, of all kinds, schools, etc.). These spittoons should be eight to ten inches in diameter, two inches in height, with *smooth* slightly inverted edges, made of strong, *smooth* glass, porcelain, earthenware, or enamelled iron, containing water to the depth of half an inch or thereby. In places of public resort there should be a clearly legible inscription on the wall '*Spittoon for the use of persons troubled with cough.*' The water must be renewed as it evaporates; the spittoons to be emptied down the water-closet, and washed daily with boiling water.

"*Cleanliness of all places is the first condition of a successful public health administration; consumptives ought especially to study cleanliness.*

"The sitting and sleeping rooms of consumptives ought to be provided with washable curtains, table covers, etc., with no carpets on the floors, or woollen runners on the stairs, and contain as little furniture as possible, with washable, easily removable covers (dusters). Elastic iron garden seats, with washable covers or movable cushions, are the most suitable furniture, and facilitate cleaning and disinfection of the room and its contents. Bedmats should be made of washable jute material.

"Wipe the *whole* floor of every room over with a damp cloth daily to remove the dust, and even in winter ventilate thoroughly for *at least* an hour. The room should be thoroughly cleaned weekly, and every three months be disinfected, according to the directions of the Code of 7th February, 1887, prescribing the process of disinfection in epidemic disease. The fulfilment of these instructions, especially the harmless removal of the expectoration, enables the intercourse of the healthy with consumptives to be carried on without scruple, and prevents the spread of this most destructive disease.

"May everybody, according to his circumstances, co-operate to this end."

It is characteristic of all official action in Germany in relation to the person of the consumptive to concentrate attention upon his expectoration. Every detail of injunction, as well as express statement, has the effect of liberating the consumptive from all social disability, so long as he is able to go about, *provided* he is careful to follow the simplest precautions as to expectoration; and when he is weak and bedridden, *provided* his attendants take up the rôle as to expectoration and are cleanly as to his other discharges. It is the same in France. Out of

the periodic "Congress for the Study of Tuberculosis," sprang a "League for the Prevention of Pulmonary Phthisis and other forms of Tuberculosis," the primary object of which was to educate the people of France by the circulation of popular literature, each member acting as a distributing centre in his own locality. Their first issue was the code of instructions which received such drastic treatment at the hands of the Royal Academy. This was included in a pamphlet of twelve pages, which has been scattered broadcast over France. The code itself is prefaced by some facts to show the gravity of phthisis as a cause of ill health and death, and by an exposition of the modern doctrine, in the course of which this sentence is printed in emphatic type:—

"We know further that the consumptive is not in the least dangerous by contact or proximity, that it is neither his body nor his breath which is hurtful, and that we can chat with him for hours, live with him for years, and even sleep in his room and give him the most constant care, without running any serious risk, *provided we take certain precautions*, the chief of which is to collect his expectoration, and not to delay the destruction of his spittle until it becomes dry, and is disseminated as dust into the atmosphere."

This position is logical and unassailable. If you accept the doctrine as sound, the practice must be conceded as sufficient. Let there be spittoons handy for everybody; don't put your spit in the way of drying and becoming dust; don't anywhere stir up the dust in inclosed places. The remedy is so commonplace that, after reading all that has been written and spoken, and proclaimed and enjoined, when we look at our notes and find nothing but sputum, spittoons, and dust, we are apt to show a little temper, like Naaman when he expected the prophet to hold a solemn function over his leprosy, and he merely told him to go and wash himself. No doubt, the very simplicity of the prescription will constitute the greatest difficulty in the way of its acceptance and observance. To the vulgar a "spittle" is symbolic of all that is insignificant and contemptible. To

base a cardinal matter of sanitary practice and regulation upon the how, and the when, and the where, people are to spit, requires some moral courage. Only a clear apprehension of, and firm belief in, the doctrine that practically consumption is communicable through dried expectoration, and nothing else, will save the practice from ridicule.

How far it is to be explained by the fear of this — how far by the imposition of modern doctrines upon the top of the conception of a vague infection, instead of entirely substituting the one for the other — we cannot say; but the fact remains that in this country the advocates of the modern doctrines never seem to regard the consumptive with any more equanimity. They expound the *modus operandi* of infection; they prescribe spittoons and proscribe dust, just as is done on the continent; but in place of manifesting confidence in the consumptive thus reformed in his habits, as they most expressly do abroad, the tendency here is to exhibit suspicion of him in all his ways. They would surround him with restrictions, and cover him with differential marks, which must make him almost as conspicuous in society as if he were clad in the gray gown and sounded the clapper of a mediæval leper —

“They curse him in eating, they curse him in drinking,  
They curse him in coughing, in sneezing, in winking”

The jackdaw of Rheims was not “a penny the worse,” but it would be far otherwise with the poor consumptive. Well may one say, “Show us your faith by your works;” but it is not the logical inconsistency, it is the cruelty, the inexpediency of these restrictions which moves our criticism. They are cruel and inexpedient, because unnecessary. They deprive the consumptive of the very advantage of the modern doctrine to which Cornet never tires of adverting, “The consumptive in himself is almost absolutely harmless, and only becomes harmful through bad habits.” Setting out from this proposition, he says,

prophylaxis is therefore simple. No more demands for legislative prohibition of marriage and other absurdities of restriction, which would consign consumptives to an island in the solitary ocean. No more demands for the separation of children from tuberculous parents, for their accommodation in institutions, for abstinence from kissing them,\* for avoidance of intercourse with consumptives, for exclusion of consumptive workmen from workshops, etc. Cornet thinks such prescriptions about the furnishing of rooms for consumptives as those in the Berlin leaflet, and as to special disinfection of sputum are futile for private houses; the hygienist must endeavor to make his demands consistent with the comforts and habits of civilized life, otherwise his voice will be as that of one crying in the wilderness. This is now possible. Prophylaxis had of late come to a standstill because of its impracticable demands. Koch's discovery, the most fruitful in medicine, seemed to exhaust itself in staining bacilli.† In short, Cornet has proved by experimental induction, if ever anything has been proved, that the sputum is practically the only source of infection in phthisis; that where there is no sputum there is no infection; that the sputum is not infectious unless it dries; that it cannot dry excepting under certain conditions, perfectly easy to be avoided; that if these conditions are avoided, a consumptive is not a source of danger to any one in the ordinary intercourse of society and the home. If this is so, we must say so; and we must not act, or make others act, as if we did not believe it.

### *Tuberculous Milk.*

There is no need for argument in reference to the milk of tuberculous cows. The facts are so universally accepted and so grave, that the administrative effect shines through them. It

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\* He means kissing on the cheek or brow, which he advises in place of osculation.

† "Ueber Tuberculose, etc.," 1890, pp. 130 *et seq.* He recurs to the same subject in his paper, "Die Prophylaxis der Tuberculose, etc." — *Berliner klin. Woch.*, May, 1895.

is precisely the Glasgow position — that a tuberculous cow must not be retained in a dairy. There is a remarkable consensus of opinion as to the influence of milk in disseminating tuberculosis, especially amongst the young. The pathologist finds “that of the total deaths under ten years of age amongst the mass of the people, about a third are due to tuberculosis,”\* and that the usual seat of the disease at that age points to food as the medium of infection. The prevalence of tuberculosis among dairy cows is notorious. Experiment shows that when the udder is affected the milk is virulent. Every authority on the prophylaxis of tuberculosis places the supervision of the milk supply next to the regulation of the expectoration of consumptives in importance. I am inclined to think that it is at least of equivalent importance. It certainly is much more practicable as a matter of sanitary administration. If we remember the habits of the tubercle-bacillus, we cannot imagine a more favorable nurture-ground than the typical byre (cow stable) — a dark or badly lighted space, with insufficient ventilating apertures, which are unhesitatingly closed when necessary to maintain a temperature of 60° to 70° F. by the heat of the animals; the air consequently loaded with carbonic acid, with organic impurities and moisture, full of the dust of dried dung, never penetrated by a direct ray of sunlight, in winter never vacated either in country or town for weeks, and in cities never vacated at all.† The natural result is that dairy stock is ravaged with tuberculosis. Yet we never hear a farmer or a dairyman speak of tuberculosis without speaking of compensation. When he puts windows in his byre, and floods it with light, ventilates it, and ceases to use his cow as a heating apparatus, it will be time enough to

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\* “Tuberculosis viewed as an Infectious Disease; its Prevalence and the Frequency of Recovery from it.” — Professor Joseph Coats, *Sanitary Journal*, 23rd November, 1891.

† See valuable paper by J. MacMillan, M. B., D. Sc., Edinburgh. — “An Investigation into the Condition of the Atmosphere of Cowhouses and Stables in Edinburgh, Leith, and the County of Midlothian.” — *Journal of Comparative Pathology and Therapeutics*, 1892.

speak of compensation. Meanwhile the children of the town are being infected wholesale, and it behooves the authorities, not only to take every means to eliminate tuberculous cows from dairy byres, but to enforce sanitary reform in the construction, use, and condition of byres. By-laws as to cubic space, ventilation, lighting, cleanliness, obtain from tuberculosis a direct interest to all men.

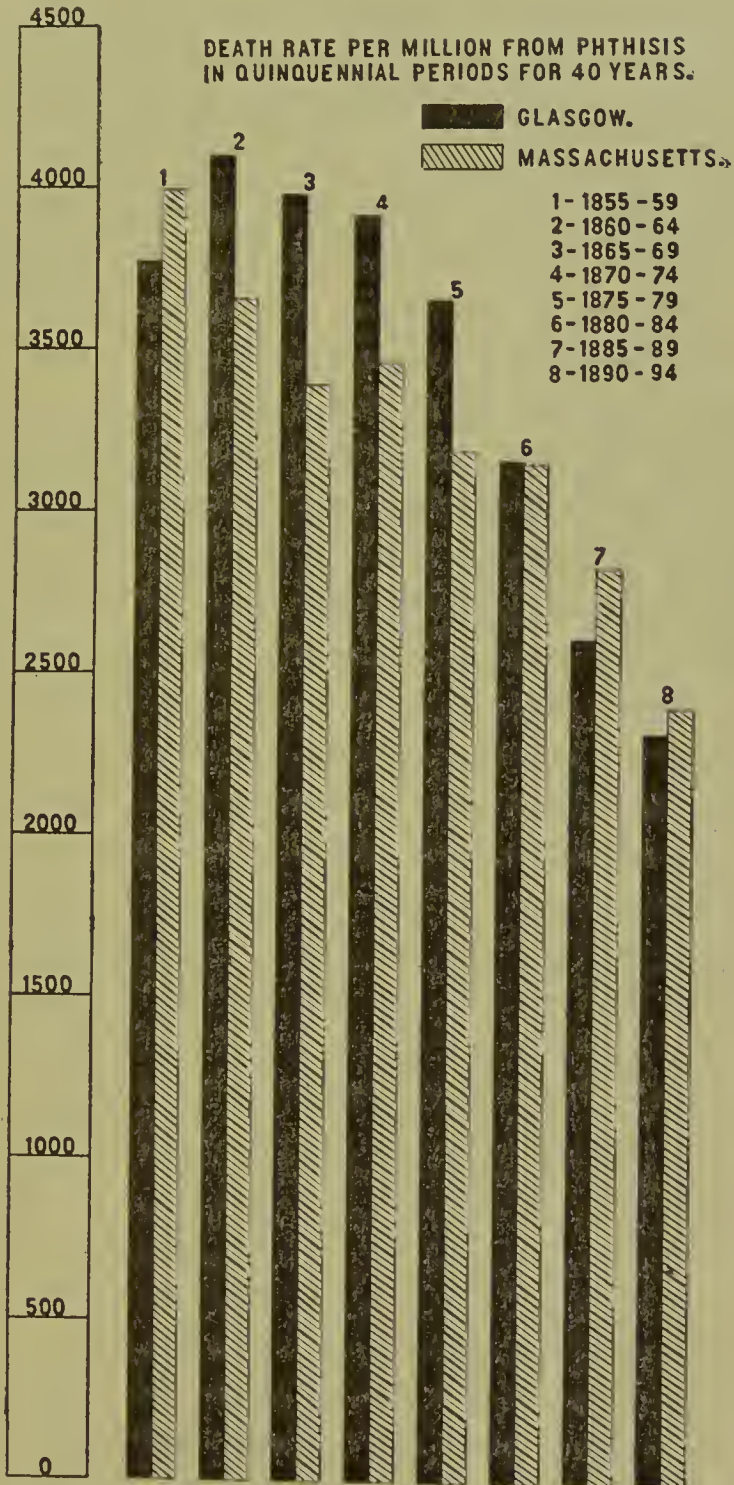
But yet more is required. A competent veterinary inspector ought to be at once appointed, who could test with tuberculin the accuracy of the suspicions suggested by his skilled general examination. In this way only can we hope to detect and abolish, as milk-producers, animals which are, no doubt, at this moment contaminating the milk supply of Glasgow. At present our powers are lying dormant. After putting our own house in order, an occasional inspection of the cattle at dairy farms, chosen at random in various parts of the country, would have a most wholesome effect, not limited to the detection of a few unsound animals, but leading up to more stringent by-laws and better sanitation in country byres. County officials require a little help from the powerful commercial lever which the purchaser of country produce can apply whenever he chooses.

#### GENERAL HYGIENE IN THE PREVENTION OF TUBERCULOSIS.

##### *Statistics.*

Glasgow itself affords a remarkable illustration of the influence of general hygienic measures upon tuberculosis, as is shown in the following diagram:—

GLASGOW AND MASSACHUSETTS—DEATH RATE PER MILLION  
FROM PHTHISIS IN QUINQUENNIAL PERIODS FOR FORTY YEARS,  
1855-94.



NOTE.—For the purpose of comparison the foregoing diagram has been remodeled so as to include the figures for Glasgow and for Massachusetts for the same periods. A table containing the figures for each year may be found at the end of this paper.

In the period 1860-64 phthisis reached its highest mortality, 4,094 per million. In the period 1890-94 it was 2,315, so that in 25 years consumption has been reduced 44 per cent. in fatality without special treatment as an infectious disease. If we turn to "zymotics" for the same periods, we find that the combined effect of special efforts and general hygienic measures has been to reduce their fatality 50 per cent. Enteric fever, which we are told tuberculosis most resembles as an infectious disease, was reduced 60 per cent. The proportion of the total deaths which took place in isolation rose from 7 per cent. to 66, which serves as an index of the extent to which every known special method was pushed. The reduction in phthisis is very notable even by the side of these figures. Unfortunately, phthisis is the only form of tuberculosis which has been throughout consistently classified by the registrar-general as a cause of death. Prior to 1883 there was a class "*tubercular diseases*," comprising "scrofula," "tabes mesenterica," "phthisis," and "hydrocephalus," but in 1883 these were all transferred to "*constitutional diseases*," as "tabes mesenterica," "tubercular meningitis (acute hydrocephalus)," "phthisis," and "other forms of tuberculosis, scrofula." A table is appended giving the returns for the 40 years as published, but the sequence of the figures shows that after 1882 "hydrocephalus," at any rate, does not represent the same thing; and information confirms what the sequence suggests, viz., that "scrofula" also is not the same. We are, therefore, shut up to the 12 years, 1883-94, for evidence of the movement of tuberculous diseases other than phthisis. Dividing them into two periods of 6 years, we find that the death rate from "phthisis" has fallen from 2,849 per million to 2,316, and from "other tubercular diseases" from 1,090 per million to 884, in both cases 19 per cent. — a result which quite casts into the shade the improvement in Prussia and Saxony, quoted from Cornet, which he puts to the credit of special prophylaxis. Clearly, then, we are warranted in asserting that among infectious diseases, tuberculosis is the

most amenable of all to general hygienic measures ; that, in fact, from these alone as good results are obtained as from hygienic measures plus isolation, disinfection, etc., etc., in the case of diseases popularly known as infectious. It is not implied that special measures directed against the infectivity might not have produced even better results ; but in view of what has been accomplished, and in view of the difficulties in the way of special prophylaxis, it is contended that more is to be expected from general hygiene.

### *The Dwelling and Consumption.*

We have already gone with some detail into the relation of local and general health to tuberculosis through their influence on the bacillus. Everything within the control of the individual which promotes and maintains soundness of body ; everything within the control of the municipality or the State which improves the physical conditions beyond which the individual living in populous communities cannot go, which raises and maintains the standard of public health, comes within the scope of the prevention of tuberculosis. So that, to treat this aspect of prevention in its fulness, would be to write a treatise on private regimen and State medicine. Nevertheless, there are some of the elements of health which tuberculosis marks with special importance.

A copious supply of pure air and distribution of direct and diffused sunlight within and without the dwelling are not only wholesome to man, but are directly fatal to the bacilli distributed outside the animal body. Sunlight is the only disinfectant which sustains the man while it kills the microbe. Therefore, whatever withdraws from the air we breathe impurity of smoke, or dust, or foul exhalation, and from the sky above us that canopy of smoke which reduces our sunshine to twilight ; everything which promotes free motion of air without and within the house ; every by-law which regulates the width of streets, the height of houses, the arrangement of buildings, so as to

offer no obstruction to the winds, and to secure as much light and as little shadow in the hours of daylight as possible, which promotes the access of the sun's rays to dwellings, and helps to make the sky visible from the floor of all inhabited rooms, which widens and brightens lobbies and staircases in tenements, which prevents dampness of foundations and walls; every regulation which checks overcrowding both in house and work place, which protects the artificer from irritating dust and fumes and secures to workers of every degree and kind natural light and pure air in the place of their employment, — all are precautions against tuberculosis.

The lungs are like every other organ, their health is promoted by free and full use. Deep inhalation of pure air — especially the open air, the air which is moving freely in the great currents we call winds, which is clarified by sunshine — gives vigor to the lungs, and supplies the heart with well oxygenated blood to be sent throughout the body, increasing the insusceptibility of every tissue. Therefore, every public park, and the flowers and music which attract people thither, every open space and children's playground, every cricket and football field, every gymnasium and drill-ground, is a precaution against consumption.

It is remarkable with what unanimity those who have studied consumption clinically testify that no diseases predispose to it more frequently than enteric fever, scarlet fever, measles and whooping-cough. Enteric fever produces a profound and long-continued depression of the vitality, which favors the lodgment of the bacillus. If, perchance, tuberculous milk should be given to such patients, who are practically sustained for weeks on milk and nothing else, it certainly would infect. Scarlet fever, in its severer forms, also reduces constitutional resistance. On the other hand, measles and whooping-cough create for the bacillus an opportunity chiefly by their influence on local health, producing debility in the lungs, to which whooping-cough frequently adds great general exhaustion. It follows from these

facts that all hygienic measures which tend to prevent enteric fever, and whatever is done to limit the spread and prevent the complications of the infectious diseases of children, are precautions against consumption.

In combating tuberculosis in the lower animals, hygienic measures bear an equally important part. Indeed, the tuberculosis of animals is begotten of the domestication of animals by man, and the perversity of man in treating them as if fresh air and sunlight were less essential to their health than to his own. The fact is they are more essential. Tuberculosis prevails among the different species in proportion to the extent to which man has, for his purposes, made them denizens of closed spaces; and most of all in the cow, which he has entirely taken possession of, and which he treats as if foul air and darkness were conditions of its being. Dogs and cats also share in the risks of the society of consumptives who are careless in their habits. The improvement of the hygiene of the domestic animals is a precaution against consumption in man.

#### SUMMARY OF SUGGESTIONS.

1. It is of supreme importance, first of all, to lay in the mind, both of the profession and the public, a broad foundation of positive knowledge. The direct and indirect practical issues of the doctrine of tuberculosis are very various, and can only be effectively worked out through the intelligence of the community. They touch the business of administrative bodies of every kind, not merely municipal, but parochial, charitable, corrective, educational, and others both of a public and private character. They affect the personal habits of a considerable proportion of the citizens, and the duties of those about them, and, in certain circumstances, are responsible for them. They concern the health of all.

2. The local authority ought to resolve that, in the interests of public health, it is necessary that washing and disinfection should be effectively carried out after every death from pulmon-

ary consumption, and at the discretion of the medical officers in the course of illness from this or any other form of tuberculous disease.

3. In my own opinion, the importance of taking immediate action in the direction of eliminating tuberculous cows from the dairies, first of all in Glasgow, and next from those sending milk into Glasgow, can scarcely be exaggerated. It is at least equivalent in promise of beneficial results to any part of the special action recommended in this report. Glasgow is in the unusual position of possessing ready to hand the legal powers to deal with this source of tuberculosis. We cannot take full advantage of these powers without a veterinary expert. Science has provided in tuberculin a test which overcomes that difficulty of diagnosis of tuberculous disease in the living animal which has hitherto made professional opinion uncertain or only equivalent to suspicion, and therefore insufficient to support decisive action. This test can be systematically applied only by a specially qualified veterinary surgeon.

4. The issuing of popular leaflets to be systematically distributed from house to house, and otherwise put into the hands of those responsible for the care of the sick, may be remitted to the medical officers to be taken in due course.

5. It is scarcely necessary to point out that many departments of municipal management ought to be inspired with renewed energy, and to receive increased precision of direction, each in its own special work, from this doctrine of tuberculosis, *e. g.* : —

In the application of general and local powers to the suppression of damp, dark dwelling-houses; to the dissemination of light and air within and around tenements and work places, whether factories, workshops, warehouses, counting-houses, or offices; in the enforcement of ventilation, light, and cleanliness in byres; in the provision of open spaces and play places convenient to tenements.

In the suppression of smoke, and the energetic application of

the law in all cases relating to overcrowding, cleanliness of the house, and other matters of domestic police, which, if not associated in the judicial mind with some large principle, are apt to sink to the rank of petty details, rather vexatious than otherwise.

Parks are only useful in proportion as they are used, and therefore they must be made attractive. Flowers are wanted for some, music for others, but always space for the young. The youthful instinct to play and sport is accessory to growth and development, and suitable space for the gratification of that instinct, may powerfully aid in building up strong, resistant constitutions.

The superintendents of railways, especially of street lines, may find moral courage to enforce their by-laws against spitting "in or upon any car," which, in fact, means to compel the male sex to refrain, for hygienic reasons, from doing that which the female sex, from a sense of propriety, never does.

6. The practical issues of this doctrine of tuberculosis, as regards the individual and the family, in matters which can only be touched by private effort, actuated by the growth of intelligence, are many and various, and must be trusted to the evolution of thought in the process of time. How to deal with *domestic dust* is, perhaps, the most important of these issues. It is to be desired that women should understand the importance of dust in the causation of consumption, and should devise methods of dealing with dust which will end in its collection and destruction, not merely in its disturbance and redistribution. Not merely as housewives, but as sick nurses, women ought to study these modern doctrines.

JAS. B. RUSSELL.

SANITARY DEPARTMENT,  
1 MONTROSE STREET, October, 1895.



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# APPENDIX.

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## APPENDIX.

*Death Rates per Million Inhabitants from Phthisis and Other Tuberculous Diseases — Glasgow and Massachusetts, 1855-94.*

|                 | PHTHISIS. |       | OTHER TUBERCULOUS DISEASES. |       | ALL TUBERCULOUS DISEASES. |       |
|-----------------|-----------|-------|-----------------------------|-------|---------------------------|-------|
|                 | Glasgow.  | Mass. | Glasgow.                    | Mass. | Glasgow.                  | Mass. |
| 1855, . . . . . | 3,977     | 4,195 | 1,790                       | 786   | 5,767                     | 4,981 |
| 1856, . . . . . | 3,411     | 4,083 | 1,536                       | 604   | 4,947                     | 4,686 |
| 1857, . . . . . | 3,772     | 3,950 | 1,668                       | 630   | 5,440                     | 4,580 |
| 1858, . . . . . | 3,738     | 3,842 | 1,813                       | 758   | 5,551                     | 4,600 |
| 1859, . . . . . | 3,814     | 3,886 | 1,492                       | 655   | 5,306                     | 4,541 |
| 1860, . . . . . | 4,327     | 3,702 | 1,670                       | 782   | 5,997                     | 4,484 |
| 1861, . . . . . | 3,988     | 3,653 | 1,584                       | 805   | 5,572                     | 4,458 |
| 1862, . . . . . | 4,116     | 3,428 | 1,651                       | 664   | 5,767                     | 4,093 |
| 1863, . . . . . | 3,837     | 3,726 | 1,834                       | 708   | 5,671                     | 4,434 |
| 1864, . . . . . | 4,200     | 3,757 | 1,742                       | 693   | 5,942                     | 4,450 |
| 1865, . . . . . | 4,135     | 3,678 | 1,768                       | 634   | 5,903                     | 4,313 |
| 1866, . . . . . | 3,928     | 3,531 | 1,672                       | 560   | 5,600                     | 4,091 |
| 1867, . . . . . | 3,861     | 3,255 | 1,724                       | 538   | 5,585                     | 3,794 |
| 1868, . . . . . | 3,965     | 3,220 | 1,701                       | 522   | 5,666                     | 3,742 |
| 1869, . . . . . | 3,969     | 3,288 | 1,796                       | 520   | 5,765                     | 3,808 |
| 1870, . . . . . | 4,306     | 3,433 | 1,911                       | 601   | 6,217                     | 4,035 |
| 1871, . . . . . | 4,346     | 3,393 | 2,112                       | 595   | 6,458                     | 3,988 |
| 1872, . . . . . | 3,955     | 3,626 | 1,871                       | 677   | 5,826                     | 4,303 |
| 1873, . . . . . | 3,557     | 3,536 | 1,815                       | 703   | 5,372                     | 4,240 |
| 1874, . . . . . | 3,374     | 3,280 | 1,567                       | 696   | 4,941                     | 3,975 |
| 1875, . . . . . | 3,949     | 3,474 | 1,660                       | 688   | 5,610                     | 4,161 |
| 1876, . . . . . | 3,836     | 3,176 | 1,607                       | 627   | 5,443                     | 3,803 |
| 1877, . . . . . | 3,468     | 3,204 | 1,885                       | 543   | 5,354                     | 3,747 |
| 1878, . . . . . | 3,676     | 3,085 | 1,906                       | 571   | 5,581                     | 3,656 |
| 1879, . . . . . | 3,289     | 2,975 | 1,701                       | 612   | 4,990                     | 3,586 |
| 1880, . . . . . | 3,153     | 3,081 | 1,603                       | 707   | 4,756                     | 3,789 |
| 1881, . . . . . | 3,111     | 3,245 | 1,340                       | 720   | 4,451                     | 3,965 |
| 1882, . . . . . | 3,064     | 3,179 | 1,547                       | 698   | 4,611                     | 3,877 |
| 1883, . . . . . | 3,361     | 3,160 | 1,124                       | 696   | 4,484                     | 3,856 |
| 1884, . . . . . | 3,054     | 3,037 | 1,111                       | 693   | 4,165                     | 3,730 |
| 1885, . . . . . | 2,967     | 3,066 | 1,189                       | 704   | 4,156                     | 3,771 |
| 1886, . . . . . | 2,878     | 2,951 | 1,131                       | 717   | 4,009                     | 3,668 |
| 1887, . . . . . | 2,499     | 2,856 | 1,004                       | 763   | 3,503                     | 3,619 |
| 1888, . . . . . | 2,336     | 2,708 | 980                         | 794   | 3,316                     | 3,503 |
| 1889, . . . . . | 2,324     | 2,565 | 936                         | 754   | 3,260                     | 3,319 |
| 1890, . . . . . | 2,499     | 2,587 | 969                         | 696   | 3,468                     | 3,283 |
| 1891, . . . . . | 2,418     | 2,396 | 903                         | 738   | 3,321                     | 3,134 |
| 1892, . . . . . | 2,187     | 2,453 | 769                         | 721   | 2,956                     | 3,175 |
| 1893, . . . . . | 2,213     | 2,310 | 882                         | 771   | 3,095                     | 3,082 |
| 1894, . . . . . | 2,257     | 2,234 | 846                         | 740   | 3,103                     | 2,974 |

*Death Rate per Million from Phthisis in Five-year Periods — Massachusetts and Glasgow.*

|                    | Mass. | Glasgow. |                    | Mass. | Glasgow. |
|--------------------|-------|----------|--------------------|-------|----------|
| 1855-59, . . . . . | 3,988 | 3,792    | 1875-79, . . . . . | 3,179 | 3,644    |
| 1860-64, . . . . . | 3,653 | 4,094    | 1880-84, . . . . . | 3,140 | 3,149    |
| 1865-69, . . . . . | 3,388 | 3,973    | 1885-89, . . . . . | 2,822 | 2,601    |
| 1870-74, . . . . . | 3,453 | 3,908    | 1890-94, . . . . . | 2,392 | 2,315    |

## A CIRCULAR OF THE STATE BOARD OF HEALTH RELATIVE TO TUBERCULOSIS OR CONSUMPTION AND THE BEST MEANS FOR PREVENTING IT.

The object of the State Board of Health in issuing the following circular is to furnish information (1) as to the nature of pulmonary consumption, (2) the conditions which favor its spread, and (3) the best methods of preventing it.

### 1. — AS TO THE NATURE OF CONSUMPTION.

Consumption is the most destructive disease of New England, the number of persons annually dying from this cause in Massachusetts amounting to nearly six thousand. Modern research places it among infectious diseases.

The specific virus or poison of the disease consists of a minute germ, the "bacillus of tuberculosis," which exists in the tissues and expectoration of the sick, and which may in various ways enter the bodies of the well and reproduce the disease in them. In the proper care and disposal of the expectoration of the sick, it is probable, lies one of the chief methods of preventing the spread of the disease.

### 2. — CONDITIONS WHICH FAVOR THE SPREAD OF CONSUMPTION AMONG HUMAN BEINGS.

*Defective ventilation.* One of the chief conditions which is favorable to the production of consumption is the continuous and habitual breathing of unrenewed air. Consequently, in workshops, factories, school rooms, public buildings, halls, churches and the inhabited apartments of dwellings and tenement-houses the absence of adequate means of ventilation favors the spread of consumption.

*Dampness of soil* on which the house stands and dampness of the immediate neighborhood are favorable conditions for the production of consumption. The occupancy as living or sleeping rooms of apartments which are constantly damp or are partly or wholly underground undoubtedly has a similar effect.

*Overcrowding* in dwellings, in factories and in workshops where men and women work for several hours each day is also a favorable condition for spreading the disease. Density of population increases the liability to this disease. Observations in Massachusetts extending over a

period of twenty years (1871-90) show that the deaths from consumption in densely settled districts, as compared with those in sparsely settled districts of the State, stood in the ratio of 1,000 deaths in the former to 727 in the latter.

Another factor which favors the spread of this disease is the presence of *dust* in the air of apartments, factories, mills and workshops. Hence occupations or trades in which men, women or children are exposed to the inhalation of irritating dust increase the liability to contract the disease among such operatives. An examination of the reports of the Registrar-General of England for several successive years shows that fishermen, who are of all classes the least exposed to dust inhalation, are also comparatively exempt from consumption.

*Insufficient and badly selected food.* While the influence of improper and insufficient feeding upon the predisposition to consumption is not so directly proven as are the effects of certain other conditions, there is yet sufficient evidence to show that a restricted diet or one composed exclusively of single elementary constituents, as, for example, the starches alone, and these in too limited quantities, probably predisposes to consumption.

*Intemperance* in the use of alcoholic stimulants has also been shown to act in the same direction.

Undue physical or mental strain, overwork, worry and anxiety and the prolonged suckling of infants (beyond ten or twelve months) are conditions contributing to the same end.

### 3. — PREVENTIVE MEASURES.

Having the foregoing predisposing conditions in view, the measures which are essential for the prevention of this disease may be more clearly understood.

1. *The prevention of overcrowding.* In tenements and in dwelling-houses the prevention of overcrowding diminishes the liability to contract tubercular diseases among the occupants.

Hence the adoption of measures which shall counteract the effect of overcrowding is desirable. Ventilation is one of the most efficient of such measures. Adequate ventilation should be provided in all factories, halls, school-houses and other buildings in which people assemble in considerable numbers. Simple methods of ventilation in the living and sleeping rooms of dwellings are also essential to healthy living.

Open fireplaces, movable transoms in sleeping-rooms, provision for admitting fresh air at the windows by special means are all useful precautions.

2. *Household as well as personal cleanliness* is essential to the prevention of consumption. The removal of dust from floors should be practised, and care should be taken that such dust is removed by such means as will insure the least diffusion through the air of rooms during their occupancy.

3. *Occupations.* The selection of a healthy occupation is a matter of no small importance.

Sedentary occupations in ill-ventilated apartments and those which expose the workmen to the inhalation of dust should be avoided. Different sorts of dust vary in harmful effects. The sharp dust produced in the grinding of needles and steel tools and in the mining of metals is especially irritating, and the mortality from consumption among operatives in such industries is high. Operatives engaged in such occupations may diminish the liability to harm by wearing "respirators" over the mouth and nose, while at work.

In several factories where consumption had made serious inroads upon the operatives, the adoption of measures for the prevention of a dusty atmosphere secured a marked diminution of the prevalence of this disease among the workmen employed in them.

Regular daily exercise in the open air is of the first importance for all persons who are engaged in sedentary occupations.

The owners and superintendents of *factories, mills and workshops* can accomplish much toward the prevention of tuberculosis among the operatives by the introduction of adequate systems of ventilation and heating, and by the use of hard, smooth floors without cracks or crevices.

The dust should be removed from the floors at night, after working hours, and not during the occupancy of the work-rooms. The use of moisture in the removal of dust, and careful wiping with damp cloths is preferable to sweeping up the dust when dry. Spitting upon the floor should be forbidden.

4. *Food.* As an essential requisite to the prevention of consumption, a diet of sound, wholesome food, in which the chief elementary forms of nutriment are harmoniously combined (the fats, starches and proteids), is necessary. Such a diet should consist mainly of bread and the various cereals, with butter and other fats in generous measure, together with

meat, fish and fruits. This does not imply a luxurious or expensive diet, but rather one that is nutritious and easily digested.

The question of the effect of the use of the *meat* and *milk* of *tuberculous animals* does not yet appear to be so well settled as to admit of an unqualified conclusion.

In the absence of absolute and definite evidence, it is therefore desirable that the *meat* of all suspected animals should be cooked thoroughly before using it as food. The *milk* of such animals should be entirely excluded from the food supply.

5. *Overwork, anxiety, worry and exhaustion* should be avoided. Mothers should be advised to *wean suckling infants* by the end of the first year.

#### DISPOSAL OF SPUTA.

6. With reference to those who are sick with consumption or tuberculosis, and especially with reference to the possibility that their presence among other human beings may prove a source of danger on account of infection, the following recommendation as to the disposal of the expectoration of consumptives should be especially noted.

Observation and experiments have demonstrated the fact that in this expectoration (especially when dried) lies the chief danger of infection and hence its proper disposal becomes a matter of prime importance. Therefore, sputa should never be allowed to *become dry*, and should be destroyed as quickly as possible. Consumptives should be instructed not to expectorate about rooms, in streets or highways, in railway or street cars, or in vehicles of any sort, but should spit into rags which can be burned, or into cups or other receptacles containing a little water or other material which may be thoroughly disinfected before the same is allowed to pass into the drain or sewer. Such receptacles should be cleansed with boiling water.

A healthy person should not sleep in the same room with a consumptive.

#### DISINFECTION.

7. Sputa may best be burned when deposited upon pieces of cloth or rags; and when put into cups or receptacles holding water the whole should be disinfected with a saturated solution of carbolic acid, which may be obtained of any reliable druggist.

Disinfection should be practised in the case of rooms or apartments which have been vacated by consumptives or those in which such per-

sons have died. There is a growing belief, supported by observation, that rooms which have been inhabited by consumptive families may become permanently infected, and ought not to be occupied until radical measures have been taken to cleanse and disinfect them. Each room vacated by a tuberculous patient should be disinfected, and especially the floor and lower parts of the walls. For this purpose washing the floor and all woodwork with a corrosive sublimate solution, one part to one thousand (about one teaspoonful to a gallon of water), should be practised, and the bed and clothing of the last occupant should be submitted to steam disinfection or to boiling water. Strong soapsuds also have efficient disinfecting power, and may be used for washing floors and woodwork. The disinfection should be thoroughly done, but especially so in cases where the habits of the consumptive in regard to disposal of his sputa have been careless.

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As a means of spreading information upon this important subject, local boards of health can undoubtedly accomplish much toward the prevention of consumption by issuing a circular like the following:—

#### THE PREVENTION OF CONSUMPTION.

Consumption is the most destructive disease of New England, the number of persons dying annually from this cause in Massachusetts amounting to nearly six thousand.

The disease is infectious, and can be communicated from one person to another. The chief danger exists in the expectoration of the sick, and if this expectoration is carefully destroyed little danger need be feared.

Consumptives should be instructed not to spit upon the floors of rooms, public halls, street and railway cars and other vehicles, nor in the streets, but into pieces of cloth or receptacles made for the purpose, containing water or a saturated solution of carbolic acid (one part of carbolic acid crystals to about fifteen parts of water). Such bits of cloth should be destroyed by fire before the sputa become dry, and other receptacles should be cleansed with scalding water, their contents having been destroyed or otherwise carefully disposed of. Handkerchiefs which may have been used from necessity should be boiled half an hour before washing.

A healthy person should not sleep in the same room with a consumptive.

Remember that sputa must never be allowed to become dry.





